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Sustainable Development through Diversifying Pathways in India

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From groundwater depletion to toxic air pollution, modernising development pathways are linked with grave unsustainability challenges, as they extend the unbridled extraction of "goods" from nature while carelessly dumping back the "bads." To move beyond this and to realise sustainable development, plural pathways may be required in each field, be it agriculture or housing. As outcomes of struggles for democracy and sustainability, these diversifying pathways may be structured around caring and cooperative (human–nature) relations.

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After more than seven decades of postcolonial development, millions of people in India are enjoying comforts and conveniences of modern life. Average incomes have increased significantly. Many consume a wider diversity of goods. Urban and even rural lifestyles in parts of the country are dynamically infused with technological innovations, ranging from 4G (fourth generation of broadband cellular network technology) smartphones to 4-wheel drives. Many agrarian practices have been transformed too, through the adoption of techno-scientific artefacts, including hybrid and genetically-modified seeds, water pumps, tractors, chemical pesticides, and fertilisers.

These "modernising" technologies are embedded in wider socio-economic processes (that is, state–society and worker–employer relation and patterns of income and wealth inequality) and environmental dynamics (that is, pollution, groundwater depletion, etc). Crucially, they implicate a specific modality of human–nature relations, in which resources are "extracted" from nature to meet the demands of (some) humans, and the effluents and wastes produced in this process are "dumped" into nature. Modernising development thus extracts what it believes to be "good" from nature and dumps the "bads" it produces back into nature, effectively treating the earth as a giant sewer (Barry 2016). In order to do this, modernisation invents and uses a range of technosciences across multiple areas of activity from mobility to energy generation and agriculture.

The extension of this "extract-dump" modality of human–nature relations through the modernising technosciences depends on multiple other forces in society. These include: capitalist desire for short-term profit and growth that tends to obscure potential harms; scientific/engineering education systems enchanted by standardisation and control of nature; policies supporting innovations considered efficient according to narrowly expedient economic criteria; regulations to "manage" pollution and waste, which often just shift the loci of dumping; attaching high status to individualised engagement with—and ownership of—technological artefacts; and social construction of the sense of freedom associated with individualisation (which in its competitive form, also serves as a norm for social control). Together, these social–institutional and political–economic forces, as they align with modern technosciences to extract natural resources and dump wastes, constitute what we term as "modernising development pathways" (Leach et al 2010).

In any field of activity, multiple pathways are possible. However, as we argue in more detail later, typically one pathway becomes dominant and self-reinforcing (that is, agricultural intensification; fossil fuel-based transportation). A pathway comes to dominate by attracting a majority of the development resources available in an area of activity. It dominates also by shaping what is imagined as practicable by designers, planners and policymakers. In this process, alternate pathways are marginalised, which also marginalises the possibilities of realising more sustainable human–nature relations that limit or transcend the extract-dump modality.

Dominant Pathway

How does one pathway become dominant, if multiple pathways are practised or possible in any area of activity? A complex range of interacting pressures operate to diminish the diversity of possible pathways and to entrench just one pathway (Stirling 2009). These include: (i) incumbent interests behind "increasing returns to scale" (Arthur 1994), and "path dependence" due to network effects and interactive learning among users of technological artefacts (David 1997; Lundvall 1988);

(ii) the accumulation of technoscientific expertise along specific paradigms and trajectories with their own methodologies of appraising viability and performance, which make alternatives look unattractive or unattainable (Vanloqueren and Baret 2009);
(iii) governance practices that replace incalculable uncertainties and ignorance by probabilistic risk (Wynne 1992; Stirling 2015);
(iv) imaginaries and discourses of development that prioritise economic growth, return on capital (for firms and their shareholders), speed, efficiency and standardisation over sustainability and distribution (Jasanoff and Kim 2009; Escobar 2010);
(v) values and expectations shaped by neoliberal regimes that aim to configure people as individual consumers (Brown 2016); and
(vi) webs of interdependence between different technologies with their sunk investments and materialities, which privilege end-of-pipe technofixes (that is, catalytic convertors in automobiles; carbon capture and storage), over sociopolitical transformations to sustainability (that is, spatially-distributing and socially-equalising public transport and urban planning systems) (Unruh 2002).

Together, the pressures end up making a dominant pathway self-reinforcing (Stirling 2009, 2018). However, this does not imply that the dominance of a pathway is inevitable. Instead, it is continually reproduced by a particular conjunction of pressures, as outlined above. The crucial issue with a dominant pathway is that it holds the future hostage. It makes change more likely along directions that are consistent with incumbent interests, path-dependent knowledges, discourses, imaginaries, values, methodologies and materialities constituting dominant pathways (Hess 2007).

For example, the dominant urban mobility pathway based on individually-owned motorised vehicles makes more likely a future in which engineers and planners are trained to build new roads and process petroleum for individual automobility; firms recover investments by manufacturing new automobiles and paving roads; users' aspirations are configured to own automobiles by a hyperactive advertising industry; and technical skills to repair motorised vehicles and infrastructures. The automobile industry then comes to be seen not only as a major source of employment for those skilled in relevant techniques, but the only imaginable one. As auxiliaries to this future, cities may plan bus rapid transit corridors and a metro network. However, the self-reinforcing dynamics of the dominant pathway also sustains increasing number of users of its technologies (Sudhakara Reddy and Balachandra 2012). Such dominance entails profound implications for the environment and for human health (Balakrishnan et al 2019).

Development Solutions

In addition, a dominant pathway conditions policymakers' visions for national/regional development. Due to the pressures listed above, the imagination of policymakers and planners is geared towards promoting solutions that fit within dominant pathways. Consider urban mobility again: over the last three decades, many cities have faced serious traffic management problems. In India, a focal policy, "solution to decongest cities," has been the building of flyovers. By normalising the increased use of concrete to tackle mobility problems, flyovers have not only contributed to environmental damage produced by the production of cement and gravel, they have also fed to the rise of sand mafias (Shrivastava 2015; Rege 2016). Critically, by privileging private vehicles over public transport (Tripathy 2018), flyovers have exacerbated problems of air pollution plaguing some of the world's most polluted cities. And, by blocking or diverting bicycles and cycle rickshaws (Harris 2018), flyovers have further marginalised the already weaker pathways structured around these technologies (Joshi and Joseph 2015).

Consider also the dominant development pathway of agricultural intensification since the 1960s. Farmers have encountered sharply declining water tables after decades of groundwater extraction (Birkenholtz 2008), alongside the continued neglect and decay of irrigation alternatives such as tanks based on rainwater harvesting (Janakarajan 2003). Exacerbating the situation are toxic pesticides, many of which have been linked not only to cancer but also to declining insect and bird populations (Sánchez-Bayo and Wyckhuys 2019; Mitra et al 2011; Mathur et al 2012). Newer pesticides are marketed as solutions to address problems produced by pesticide use, such as "pest resistance." Farmers are thus forced onto technological treadmills, adopting newer expensive pesticidal innovations every few years (Stone and Flachs 2017; Shetty 2004). Adding other costly farm-inputs (that is, genetically modified seeds), climate variation and unreliable crop prices to this mix, we get the perfect storm of an agrarian crisis that has hit smallholders across rural India for over two decades now (Reddy and Mishra 2009; Vasavi 2012; Jakobsen 2018).

Similar socioecological dynamics are associated with the dominance of modernising development pathways in other areas such as mining, electronics (plastics, heavy metals), electricity generation (coal, large dams), packaging (plastic waste), pharmaceuticals (antibiotic resistance), and housing (sand shortages, mining). Critically, the health and displacement burden associated with the extract-dump modality underpinning modernising pathways are borne most severely by poor people, often belonging to socially marginalised groups. The "bads" are therefore also dumped disproportionately on such people. They are most directly exposed to toxic air, water and soil pollution produced by mining sites (Saha et al 2011). As farm-workers, they might be the ones critically harmed by pesticide poisoning (Kumar 2014). They are also the ones who handle hazardous wastes, often without protection (Borthakur 2015; Harriss-White 2017).

The movement for eliminating manual scavenging has been fighting a long battle against caste discrimination, and drawing attention to the criminal neglect of undignified and unsafe working conditions for sanitation workers with little investment in sustainable alternatives (Goswami 2018). These and other injustices have been highlighted by political ecologists by focusing on environmentalism of

the poor in support of calls for environmental and climate justice (Guha and Martinez-Alier 1997; Chu and Michael 2018). Recently, post-growth thinking developed in the global South is also gaining visibility (Gerber and Raina 2018; Kothari et al 2014). Such research is of critical importance in bringing neglected imaginaries to light and to draw attention to people's struggle against dispossession in varied forms. What needs further articulation are sociotechnical practices that can be strengthened to build alternatives to modernising development pathways: alternatives that are not underpinned by the extract-dump modality of human–nature relations.

This pluralisation of development pathways, while undoing the dominance of modernising development, is crucial for meeting the United Nation's 2015–30 sustainable development goals (SDGs). This is not about tinkering with current dominant pathways. Instead, it is about the promotion of the conditions fostering emerging (but currently marginalised) sustainable pathways, which are often impeded by the dominant pathways. Modernising pathways are even impeding further social progress in their own terms of generating economic growth and securing the comforts of modern living, due to the serious environmental and health hazards they are linked with. As we begin to grasp these hazards, including rapidly declining insect populations, rise of superbugs with antimicrobial resistance, and increasing casualties of urban air pollution, it is evident that development pathways must be diversified, also for achieving social justice, including intergenerational justice.

Sustainable Pathways

In any area of activity, from housing and agriculture to transport and healthcare, dominant modernising pathways coexist with potential alternate pathways. The latter might have been historically marginalised. However, underscored by the scale of environmental damage in recent decades, some alternate pathways have gained considerable ground. In energy generation, for example, alternate pathways around wind and solar power have become widespread. These pathways offer crucial hope for sustainability transformations. Yet, this hope (Powell and Depelteau 2013) must contend with two fallacies.

The first of these is a "fallacy of technological solutionism" (Gardner and Warren 2018), which reduces sustainable development pathways to technological solutions (Winskel et al 2013; Morozov 2013; O'Riordan 1989). While it is clear that some technoscientific innovations are crucial for sustainability transformations, as noted above, development pathways require social-institutional and political-economic alignment and restructuring.

Second, there is a "fallacy of ecological modernisation" under which it is expected that (i) sustainable development pathways can be fit into some niches of modernity (Latour 1998); and (ii) the processes constituting sustainable development pathways can be similar to those propelling modernising development pathways. The latter processes include capitalist short-termism, individualisation, standardisation and control of nature. Social dynamics reproducing particular pathways operate as much from "outside in" as from "inside out" of the pathways. This means that effecting shifts away from dominant pathways is a "gestalt" process (Naess 1995), also requiring engagement with entire political milieu (Stirling 2018). So, modernisation cannot simply be redirected to achieve sustainability, but must instead be countered, in order to transcend the extract-dump modality of human–nature relations linked with most socioecological challenges facing the world.

As emphasised by the SDGs (UN 2015), pathways to sustainability entail not the quest for higher individual status through consumerism, but rather egalitarian commitment and democratic mobilisation drawing on multiple sources beyond the confines of modern technoscientific laboratories and workstations (Smith and Stirling 2018). In the following, using examples from housing and agriculture, we briefly illustrate how people have attempted to mobilise knowledges and other resources to build fledgling pathways to sustainability.

Construction is one of India's fastest-growing sectors, using vast amounts of steel, cement and sand. The widespread use of bricks has also led to a large-scale conversion of agricultural lands into brick kilns, while contributing to soil erosion. Yet, civil society actors such as the Centre of Science and Technology for Rural Development (COSTFORD) in Kerala and the Auroville Earth Institute in Puducherry, sometimes supported by concerned scientists in public research institutions (that is, the Centre for Sustainable Technologies, formerly known as Application of Science and Technology for Rural Areas, ASTRA, Bengaluru), have developed alternate building technologies drawing on "traditional" mud-based building knowledges, while repurposing them to ensure better strength and resistance to different climatic conditions (such as higher moisture levels).

ASTRA, for example, has developed mud bricks that are sun-baked, made using the mud that is dug out for sinking in foundational structures. Such approaches practice egalitarian commitment by focusing on low-cost housing, also by using recycled materials. They attempt to situate building technologies in local contexts. For example, COSTFORD, supported by Kerala government, has promoted low-cost sustainable housing using materials from within a 5-kilometre radius of the construction location.

Unfortunately, self-reinforcing pathways structured around these technologies have been difficult to build. Barring limited success in Kerala, the appeal to policymakers has been sporadic. Democratic mobilisation of multiple knowledges of labourers and masons has been limited. Offering limited avenues for quick profit and growth, building pathways around these technologies holds no appeal for construction companies catering predominantly to urban middle-class buyers. Civil engineering careers too rely on knowledge of standardised mainstream practices.

In agriculture, over the last few decades, initiatives and experiments for agroecological sustainability have challenged the dominant modernising pathway structured around the green revolution model of energy-, water- and synthetic

chemical-intensive farming. Civil society organisations and farmers' groups have developed diverse sustainable agricultures embedded in particular regional ecologies. These include:

(i) System of rice intensification, involving a wide range of knowledge-producing actors such as small farmers, scientists and state governments (Prasad et al 2012; Sabarmatee 2014);

(ii) experiments with sustainable and equitable forms of dryland farming (RRA Network 2017; Ramdas 2018); and

(iii) zero budget natural farming movement (ZBNF) that addresses rising and chronic indebtedness among farmers (Khadse et al 2017; Muenster 2018).

These diverse agroecological pathways have been strengthened by farmers' discontent and disillusionment with the dominant green revolution modernisation pathway (Suthar 2018). National-level mobilisations of farmers' organisations are emphasising environmental sustainability alongside viable incomes and livelihoods for farmers and rural workers (for example, AIKS 2018).

Something akin to a self-reinforcing development pathway seem to be emerging around ZBNF following tireless advocacy by proponents. The Andhra Pradesh government has allocated significant resources to scale-up ZBNF, which has been followed by several other state governments and an endorsement by NITI Aayog (Aggarwal 2018). But as critics have pointed out, such scaling-up should not reduce ZBNF to just another techno-fix, jeopardising farmers' autonomy and democratic mobilisation (Bhattacharya 2019).

Discussion and Conclusions

Modernising development in any given area of activity diminishes the diversity of possible pathways, by aligning a complex web of forces around a single (or a small set of) dominant pathway(s). These forces make the dominant pathway self-reinforcing in multiple ways. First, interdependencies between the forces directly implicated within this privileged course of development have the effect of promoting each other. Second, the privileged pathways thereby substitute and directly impede the emergence of alternative pathways. Third, the more general technologies, interests, values, understandings and imaginations that are most strongly implicated within this dominant pathway are thereby promoted in wider political cultures. And this can, in turn, have the effect of consolidating the wider political conditions that favour this pathway in a mutually-reinforcing "gestalt" interplay between unfoldings of particular pathways and the entireties of encompassing societies.

The individualising-extracting-dumping practices implicated in the modernising development pathways discussed here, actively threaten the survival in other parts of society, of still-struggling practices based more around collective-cooperative-caring practices in human–nature relations. So, the empowerment of these latter mutualistic dynamics is the key to disrupting and substituting the dominant pathways. Crucially, this raises the political and economic stakes, in otherwise ostensibly very specific and circumscribed (technological) interventions around sustainability. Shifting away from particular unsustainable pathways is "part and parcel" of the broader aim of escaping the more general extract-dump modalities of modernity.

It is evident that dominance by these modernising development pathways has led to multiple socioecological unsustainabilities, from toxic pollution to soil depletion, water scarcities and increasing inequality, highlighting the critical importance for greater political mobilisation around sustainable development pathways that do not embed modernisation's extract-dump modality of human–nature relations. Despite powerful economic interests that influence public institutions and capture public resources, many fledgling sustainable pathways continue to exist. It is in this regard that the crucial importance emerges of the particular examples we have discussed here from housing and agriculture.

While development thinking has highlighted post-growth visions and drawn attention to environmentalism of the poor, the ideology of development through extractivist economic growth at any cost, continues to dominate the policy landscape. Most alternative pathways are emerging not out of incumbent firms, but rather out of sociopolitical movements that only reach the policy-makers' ears during an election year and are then incorporated in piecemeal ways at best (Guha and Joe 2019). Like corporate interests, mainstream political parties are driven by short-termism and they neglect or dissociate ecological sustainability from social justice. It is time, therefore, to push for an overhaul of the policy framework and public discourse on sustainability that goes beyond tinkering and incremental changes. This requires persistent efforts to make visible and lend support to collective-cooperative-caring practices being cultivated through civil society initiatives and through the struggles of oppressed people against dispossession (Padel and Das 2010; Sharma 2012).

Perhaps, most of all, these practices and struggles illustrate the need for situation-specific thinking that can only thrive within substantive distributed democracies. But, here, it is important to avoid a romanticisation of distributed participatory agency that alone can ostensibly challenge the entrenched concentrations of modernity, lest we replicate romanticisation of technological solutionism regarding the progressive agency of modern techniques. Struggles towards sustainability are as much about challenging and building structures, as about enabling and redirecting progressive agency. And, it is precisely in this interplay that the combined technical specificity and open political latitude of the SDGs offer crucial scaffolding for situated transformations.

Either way, the building of cross-regional, cross-sectoral alliances and solidarities between social struggles is crucial for realising the required forms of substantive distributed democracy. Even as struggles for alternative pathways need to be coordinated to resist modernist projects, their plurality reinforces that sustainability cannot be enacted through a standardised template. The recent agrarian mobilisations have brought together plural voices of Adivasis, landless workers and small farmers on a common platform, while garnering limited support from sections of the urban middle classes.

Such political mobilisation and alliances though are harder to realise for alternative pathways, in sectors such as construction and transport. These sectors are driven by powerful corporate interests, aligned with politicians and a technocratic bureaucracy, which are not easily challenged by a dispersed and precarious workforce and individualised users. Again, then, progress in specific settings requires transboundary engagements and solidarities that span the entire waterfront of social justice movements as a whole.

In the end, struggles for sustainability and democracy go hand in hand. The challenge lies as much in disrupting particular unsustainable pathways as in making more visible, the general interconnections across the extract-dump modalities of modernity as a whole. So, as we have tried to show here, this imperative transcends seemingly disparate sectors. The patterns of extractive dispossession and dumping fuelling aspirational middle-class lifestyles span divisions between regional settings, geographical scales, or urban and rural. And, here, the task of effecting transformations to sustainability is a shared responsibility. The required shifting in public discourse and practice involves interlinked roles for activist scholarship, campaigning popular media, local collective action and general political mobilisation alike.

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